GMP 12

Good Measurement Practice on Standard Operating Procedure Selection

Good laboratory practices, use of proper standards and equipment, and selection of standard operating procedures are essential for providing calibration results with accurate and traceable values with appropriate and suitable uncertainties. The following matrix recommends SOPs based on the parameter, type of test items, and level of uncertainty needed.

Parameter	Test Item	Recommended SOP
Mass (NISTIR 6969, 2014 and NISTIR 5672 2014)		
	Railroad test cars	SOP 27, Railroad Test Cars using a Master Track Scale
	Weight carts	SOP 33, Calibration of Weight Carts (References SOP 4 and SOP 7)
HB 105-1, Class F ASTM, OIML	Class F Class 5, 6, 7 Class M1, M2, M3 e.g., 10 kg to 250 kg (≥500 lb) cast iron 1 mg to 5 kg (1 µlb to 10 lb) stainless steel	SOP 8, Modified Substitution - may be used if expanded uncertainty is less than 1/3 of the tolerance SOP 7, Single Substitution - to be used, as a minimum, if conditions given for SOP 8 cannot be met NOTE: Balances and standards must be selected properly for these conditions to be met.
ASTM, OIML	Class 3, 4 (P) Class F1, F2 e.g., 1 kg kit, 100 g kit	SOP 7, Single Substitution - may be used if expanded uncertainty is less than 1/3 of the tolerance. If uncertainty is greater than 1/3 of the tolerance, then use SOP 4. SOP 4, Double Substitution - to be used for buoyancy corrections and if expanded uncertainty is less than 1/3 of the tolerance Modified SOP 4/5, to be used to incorporate measurement control into SOP 4 NOTE: Balances and standards must be selected properly for these conditions to be met.
ASTM, OIML	Class 1, 2 (S, S-1) Class E2 for use in balance calibration	SOP 5, 3-1 Weighing Design (preferred) Modified SOP 4/5, to be used to incorporate measurement control with SOP 4

Parameter	Test Item	Recommended SOP
ASTM, OIML	Class 0, 1 (S) Class E1 for use as laboratory standards	Weighing Designs per TN 952, TN 844, NISTIR 5672, SOP 28, with appropriate check standards; SOP 5 may be used as well.
Volume (NISTIR 7383, 2013)		
HB 105-2	Glass flasks	SOP 14, Gravimetric Calibration of Volumetric Standards Using an Electronic Balance SOP 16, Calibration of Measuring Flasks Volume Transfer Method (acceptable)
HB 105-3	20 L test measures (5 gal or 10 gal)	SOP 19, Calibration of Graduated Neck-Type Metal Provers (Volume Transfer Method) is preferred. When temperature instability is observed during the calibration process, SOP 19 must be used. SOP 18, Calibration of Graduated Neck-Type Metal Volumetric Field Standards Using a Slicker-Plate Type Standard, may be used if temperature stability and limits are acceptable (single delivery from slicker plate type standard; if glass standards use SOP 19.
HB 105-3	Large graduated neck type provers - used for meter verification	SOP 19, Calibration of Graduated Neck-Type Metal Provers (Volume Transfer Method)
HB 105-4	LPG provers	SOP 21, Calibration of LPG Provers
HB 105-7	Dynamic Small Volume Provers	SOP 26, Gravimetric Calibration of Dynamic Volumetric Systems used as Standards
	Laboratory standards Glassware: burets, pipetes, flasks	SOP 14, Gravimetric Calibration of Volumetric Standards Using an Electronic Balance
	Laboratory standards Laboratory slicker plate standards	SOP 14, Gravimetric Calibration of Volumetric Standards Using an Electronic Balance
	Micropipetes	SOP 14, Gravimetric Calibration of Volumetric Standards Using an Electronic Balance

Parameter	Test Item	Recommended SOP
HB 105-3	Large graduated neck type provers - used as laboratory standards	SOP 19, Calibration of Graduated Neck-Type Metal Provers (Volume Transfer Method) OR SOP 14, Gravimetric Calibration of Volumetric Standards Using an Electronic Balance
Length		
	Tapes	SOP 11, Bench Method (lower uncertainties) OR SOP 12, Tape to Tape
	Rigid Rules	SOP 10, Rigid Rule
	Pi Tapes	SOP 23, Pi Tape Calibration
Liquid-in-Glass Thermometers		
HB 105-6	Field standards for weights and measures	SOP 25 (unpublished)
Timing Devices		
HB 105-5	Field standards for weights and measures	SOP 24
Traffic Speed Gun Tuning Forks		
	For highway official use	SOP 22 (unpublished)

Parameter	Process	Recommended SOP
Measurement Assurance		
All Process Measurement Assurance	SOP 30	Use of process measurement assurance programs
Mass	SOP 5, 28	Use of check standards in procedure TN 952, TN 844, NISTIR 5672
Mass	SOP 4, 6, 7, 8	SOP 9
Length	SOP 10, 11, 12, 23	Redundancy built into procedures with replicate measurements

Parameter	Process	Recommended SOP
Measurement Assurance		
Volume	SOP 13, 14, 15, 16, 18, 19, 21, 26	SOP 17, laboratory check standards OR SOP 20, standard deviation charts and range charts
Temperature	SOP 25	Use of check standards in procedure
Uncertainty		
All parameters	All SOPs	SOP 29, Calculation of Uncertainty